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Post-Pandemic Mathematic Teachers' Perception on TPACK and Classroom Management Self Efficacy in Online Teaching

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Educational technology professionals commonly utilize the Technological Pedagogical and Content Knowledge (TPACK) framework. Yet, the existing studies lack an examination of the influence of mathematics teachers' perceptions of TPACK on their Classroom Management Self-Efficacy in the context of online teaching. This quantitative cross-sectional survey aimed to explore the potential impact of TPACK on mathematics teachers' online classroom management, which is significant to improve online teaching. The study involved 232 mathematics teachers from Kuwaiti primary schools who were randomly selected through cluster sampling, who completed a questionnaire consisting of 42 items. The questionnaire aimed to investigate both teachers' perception of classroom Management Self Efficacy in online teaching, and their TPACK perceptions. Through the utilization of multiple regression analysis, the data revealed a significant correlation between the TPACK component (CK, TK, PK, PCK, TCK, TPK, and TPACK) and classroom Management Self Efficacy in online teaching. Consequently, this study highlights the validity of TPACK as a model to elucidate teachers' effective management of online classrooms. The results of this study contribute to international studies on online teaching efficiency, teaching practices, and teacher technological competencies.

Keywords: TPACK, Classroom Management Self Efficacy, Mathematics teachers, online teaching

INTRODUCTION

As early as 2000, TPACK received support from the National Council of Teachers of Mathematics (NCTM) through its Standards for a New Century, which included the Technology Principle. This principle emphasized the importance of technology in mathematics education, impacting both the content taught and the enhancement of student learning (NCTM, 2000, p. 24). The TPACK framework encompasses the interconnection and intersection of technology, pedagogy, and content knowledge, forming an overarching construct. In mathematics education, these standards provide valuable guidelines for understanding and applying TPACK principles (Niess et al., 2009). Therefore, it is essential to provide educators and learners with regular access to technological tools that foster skills like mathematical sense-making, logical reasoning,

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complex problem-solving, and effective communication, transforming mathematics education for the digital era. Strategic use of technology in education allows educators to broaden the accessibility of mathematical instruction to a diverse range of students (NCTM, 2011). The TPACK is a dynamic construct that delineates the knowledge possessed by teachers. Its utilization is crucial in developing, implementing, and assessing curriculum and instructional strategies that integrate technology (Kumala, et al., 2022; Taopan et al., 2020).

As COVID-19 approached, educational systems recognized the immense potential of digital technology in mathematics education (Alabdulaziz, 2021; Tay et al., 2021). The pandemic has also brought about changes in the goals for teaching mathematics. Three trends in mathematics education have emerged: The use of digital technology, the philosophy of mathematics education, and critical mathematics education. The introduction of digital technology into the mathematics classroom has led to its growing dominance in the field of mathematics education. COVID-19 forced courses online, highlighting the importance of addressing unique challenges in mathematics teaching (Borba, 2021). COVID-19 had a significant impact on mathematics education, increasing reliance on online teaching and digital tools (Engelbrecht et al., 2023; Ní Fhloinn & Fitzmaurice, 2022).

Classroom management in online teaching emerged as a crucial issue during pandemic and continued to be relevant after opening schools (Lathifah et al., 2020). Educators faced the sudden challenge of adapting their classroom-based teaching strategies and resources to the online environment (Klemer et al., 2023; Livy et al., 2022). During the initial stage of school closures, mathematics teachers relied more on broad digital tools for lesson delivery and student communication rather than mathematics-specific learning settings, as noted by Drijvers et al. (2021). During the first stage of school closures, mathematics teachers utilized a range of digital tools, such as video conferencing software, learning management systems, and online collaboration tools. These platforms enabled the seamless exchange of mathematical information, real-time communication, and interactive presentations (Drijvers et al., 2021). In order to improve online teaching, this study investigates teachers' perceptions of their competence in TPACK and self-efficacy in online classroom management, as well as the relationship between TPACK and self-efficacy.

Classroom Management Self Efficacy in Online Teaching

Just like in face-to-face classes, effective management is essential in online classes to prevent them from getting out of control and to ensure that students receive valuable and meaningful learning information. For online classes to be successful, a clear understanding of roles and responsibilities is crucial for both teachers and students (Ghateolbahra & Samimi, 2021). Additionally, classroom management may be affected by changes in the online learning atmosphere compared to traditional educational settings.

Teachers are encountering new factors that broaden their classroom management skills, such as the integration of ICT in educational settings to enhance teaching and learning practices (Saritepeci, 2022). This evolution necessitates teachers' adaptability and proficiency in utilizing technology for effective classroom management. The transition to online education during the COVID-19 pandemic brought challenges and opportunities for educators. Paudel (2021) highlighted the necessity to effectively manage time, ensure a reliable internet connection within their professional environment, foster learners' autonomy in navigating their educational journey, allow learners more flexibility in terms of temporal and spatial constraints, create a sense of social isolation, and experience delays in providing feedback. The effectiveness of online education relies on instructors' pedagogical skills in creating and managing online learning environments (Paudel, 2021). Online learning has introduced new perspectives on classroom management, particularly in primary school settings. In the past, educators focused on creating an enjoyable, welcoming, comfortable, and secure classroom environment for learning. During the COVID-19 pandemic, educators must adapt classroom settings to online environments while striving to maintain a similar atmosphere to that of traditional classrooms (Lathifah et al., 2020).

Lathifah et al. (2020) highlighted the characteristics of online learning, which involve synchronous class sessions connecting teachers and students at specific times, physical location disconnection between them, and utilization of certain platforms for use for specific users. Self-efficacy in classroom management refers to teachers' belief in their ability to maintain order in a classroom (Brouwers & Tomic, 2000, 242; Slater & Main, 2020). It involves the individual's willingness to take specific actions and their persistence in implementing these actions despite difficulties.

Baroudi and Shaya (2022) conducted a study on teachers' self-efficacy in online teaching and found a high level of perceived self-efficacy in this context. The study highlighted two main factors that significantly predict participants' sense of self-efficacy: receiving support in designing online instruction and receiving professional development in online teaching. These factors play crucial roles in enhancing teachers' confidence and effectiveness in conducting online classes. Teachers with prior online teaching experience scored higher on self-efficacy. At the onset and conclusion of the COVID-19 school lockdown, Ma et al. (2021) conducted a retrospective survey on school teachers' online teaching efficacy. Despite no significant increase in self-efficacy for online instruction, there was a significant increase in self-efficacy for technology applications. Teaching self-efficacy is influenced by factors like lack of online teaching experience, limited teacher-student interaction, and inadequate school administration. Farkhani et al. (2022) found that teachers exhibited the ability to choose suitable classroom management strategies in both online and face-to-face classes. Moreover, during the COVID-19 pandemic, teachers demonstrated a positive attitude toward managing the online classroom (Farkhani et al., 2022). While numerous studies have explored high self-efficacy in online teaching (Baroudi & Shaya, 2022; Farkhani, et al.; 2022), few have specifically examined Classroom Management Self Efficacy in online teaching (Shen et al., 2023).

TPACK and its Implications in Mathematics Education

TPACK is a significant model for describing teachers' competence in using technology effectively (Schmid et al., 2020). Its theoretical framework emphasizes the interaction of three essential elements: technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK).

According to Koehler and Mishra (2009), defined pedagogical knowledge (PK) refers to the in-depth familiarity that teachers have with the procedures and techniques used in instructing and learning. Additionally, they defined content knowledge (CK) as teachers' knowledge of the material to be taught or studied. Lastly, TK is a technological understanding of technology and its ever-changing nature. As a result of TK, CK, and PK intersections form four hybrid components: TPK, TCK, PCK, and TPACK (Koehler & Mishra,2009): 1. Pedagogical content knowledge (PCK). 2. Technological pedagogical knowledge (TPK): TPK involves understanding how teaching and learning can be transformed when specific technologies are used in particular ways. 3. TCK is the understanding of how technology and content interact and influence each other. 4. Technological pedagogical content knowledge (TPCK).

Consistent and frequent engagement with technological tools is crucial for educators and learners, as it facilitates and advances the development of mathematical sense-making, logical reasoning, complex problem-solving, and effective communication. Strategic use of technology in education can broaden access to mathematical instruction for diverse students (NCTM, 2011). Research shows that teachers align with NCTM's objectives, fostering students' conceptual understanding through technology (Hill & Uribe 2020). Mathematics educators are increasingly urged to gain technology knowledge for optimal classroom use, enhancing student learning (Smith & Zelkowski, 2022). Patahuddin et al. (2016) found that analyzing critical events in authentic mathematics teaching can aid teachers in developing TPACK, guiding them to integrate technology effectively. Bakar et al. (2020) emphasized the positive correlation between mathematics teachers' self-efficacy in technology integration and the comprehensive Technological Pedagogical Content Knowledge (TPACK) construct, further emphasizing the benefits of theory-practice integration through critical events. Multiple studies, such as Alrwaished et al. (2020) and Urbina & Polly (2017), support the effectiveness of TPACK in teaching mathematics. Additionally, Akturk and Ozturk (2019) concluded that teachers' TPACK is a predictor of student achievement. Consequently, Saputra and Chaeruman (2002) recommended increasing the diversity of research types and selecting the most appropriate research methods for future studies that support TPACK.

The Relationship Between TPACK Components and Classroom Management Self Efficacy in Online Teaching

During the pandemic, teachers embraced online teaching as a new method to ensure learning continuity. Possessing TPACK components is crucial for mastering technological knowledge in today's educational landscape. Rokhmaniyah et al.'s study (2020) findings revealed that implementing TPACK approach alongside the Higher Order Thinking assessment enhanced teacher competence in class management, including creating learning videos, live worksheets, and Higher Order Thinking-based assessment tools. Integrating technology into the classroom environment also impacted classroom management.

There is evidence suggesting that mastering TPACK components has an impact on aspects of classroom management. Saritepeci's study (2022) concluded that teachers' classroom management skills in technology-enriched classrooms are affected by the development of computational thinking and TPACK levels. The study suggested that teachers with TPACK levels play a significant role in finding effective solutions to classroom management problems in technology-rich classrooms, thereby preventing the diversification of such issues (Saritepeci, 2022). At the same time, Liang (2015) found that preschool teachers with the high commitment to classroom authority perceived technology-related knowledge as more crucial compared to other teachers concerning all technologically related knowledge (TCK, TPK, and TPACK). Moreover, Shen et al.'s (2023) study revealed that teachers with higher self-efficacy tend to have greater pedagogical content knowledge (PCK) self-efficacy. In contrast, teachers with traditional conceptions of teaching and learning exhibited significantly lower self-efficacy, which was also reflected in their PCK self-efficacy. In summary, studies examining the influence of TPACK on Classroom Management Self Efficacy in online teaching are scarce globally, particularly in the Middle East and Kuwait

Mathematics Education in Kuwait Context

Kuwaiti students' performance in mathematics and science has been consistently poor in international assessment tests (TIMSS) conducted in 2007, 2011, 2015, and 2019 (Mullis et al., 2016). TIMSS participation has allowed Kuwait to identify the strengths and weaknesses of its education system, leading to revisions in its science and mathematics curricula. The pandemic caused a prolonged suspension of education for over six months, leading to a transition to online teaching methods for teachers (Alsaleh, 2021). Studies conducted during the pandemic highlighted the challenges faced by teachers in adapting to online teaching (Alsaleh et al, 2022). Alrwaished (2022) found that distance teaching posed several obstacles, including teachers' limited ability to design interactive activities, insufficient focus on developing students' mathematical reasoning skills, and students' lack of understanding of the basic elements that make mathematics an effective learning experience. After the pandemic, Kuwait suspended regular online teaching to address the learning gap but maintained it as a contingency measure for crises, adverse weather, and pandemics. Kuwait's Ministry of Education adopted an automatic switch to online education in such situations.

Research Questions

1. What is the primary mathematics teachers' perception of TPACK post COVID-19?
2. What is the primary mathematics teachers' perception of self-efficacy in online classroom management?
3. Is there a relation between TPACK mathematics teachers' perception and teacher self-efficacy in online classroom management?

METHOD

Research design

The quantitative descriptive approach was chosen to answer the research questions as it allows for the examination of the relationship between dependent and independent variables (Creswell & Creswell, 2018). This study enhances the comprehension of TPACK components in relation to teacher self-efficacy in online classroom management in teaching mathematics in Kuwaiti schools through extensive data collection.

Instruments

Questionnaire design considered dependent and independent variables. The TPACK instrument contained seven components adapted from Schmid et al. (2020) study. This instrument was chosen due to its high level of reliability and wide range of application worldwide. Moreover, the Classroom Management Self-Efficacy Instrument (CMSEI) was adapted from Slater and Main's (2020) study since it corresponded with the study objectives and was modified for use in online classroom management.

Instrument validity and reliability

The content validity of an assessment instrument indicates how well it represents the target construct for the instrument's purpose (Almanasreh et al., 2019). The researcher translated the English both instruments' items into Arabic, which two bilingual translators vetted. The questionnaire's initial version comprised 42 items. A panel of three professors and five seasoned mathematics teachers reviewed the content in Kuwait to confirm its validity. Expert suggestions led to item revisions. In addition, Lawshe's CVR formula was used to analyze content validity using the final version of the instrument, which is widely used for measuring content validity. The content validity ratio (CVR) was .79 which was acceptable (Almanasreh et al., 2019).

To ensure reliability, A 50-teacher sample from a randomly picked school took pilot surveys, testing the primary questionnaire's remaining 42 items for reliability. Cronbach's alpha measured internal consistency in this study, yielding an alpha of .98. Subscale reliability was satisfactory, between 0.760 and 0.98. A five-point scale from "strongly disagree" (1) to "strongly agree" (5) rated all items.

Dependent variable: Mathematics teachers' perception on classroom management self-efficacy in online teaching (CMSEOT). The researcher employed 14 items from Slater and Main's (2020) Classroom Management Self Efficacy Instrument (CMSEI), adapting it to for online teaching to craft a research-appropriate questionnaire. The internal consistency reliability (Cronbach's alpha) for this questionnaire was 0.96.

Independent variables: TPACK components. After reviewing the literature (Schmid et al., 2020), a 28-item draft scale was constructed. It contained four items for each TPACK component (CK, TK, PK, PCK, TCK, TPK, and TPACK). The finalized 28-item questionnaire included statements. The internal consistency reliability (Cronbach's alpha) for the questionnaire was 0.97. Reliability Using Cronbach's Alph for all components are reported in Table 1.

Table 1
Reliability using Cronbach's Alpha

Component	Cronbach's Alpha
CK	0.96
TK	0.95
PK	0.94
PCK	0.92
TCK	0.95
TPK	0.94
TPACK	0.96
CMSEOT	0.96

Participants

This study targeted mathematics teachers in public primary schools in Kuwait. Kuwait features 281 primary public schools across six educational districts, serviced by roughly 57,669 teachers in all subjects as of 2018 (Ministry of Education, 2023). A total of 232 mathematics teachers completed the questionnaire; see Table 2.

Table 2
Demographic information of the participants (N=232).

Gender	Male	17
	Female	215
Experience	Less than 5	59
	6-10 years	74
	11-16 years	66
	More than 20	33
Teaching Qualification	Bachelor	209
	Graduate	23

Data Collection and Procedures

In this study, the researcher used cluster sampling, a method that allows researchers to create sampling frames for widely dispersed units, such as schools, hence its broad application (Krathwohl, 2009). Cluster random sampling involves dividing the population into clusters or groups, each of which contains public primary female and male staff schools. To achieve a valid representation of the population, each school (cluster) was randomly selected according to staff gender. The sample consists of all the math teachers in the selected schools. The researcher specifically targeted mathematics teachers because of her interest in mathematics teaching. The total number of mathematics teachers working in primary schools is 3680, of which 95% are female (Ministry of Education, 2023). Due to the decline in male teachers in the public education sector, Kuwait's Ministry of Education decided to feminize primary school staff except for one per district. Initially, to secure survey permissions, the researcher met with school principals, seeking consent to administer questionnaires to

Mathematics teachers. Focusing on mathematics instructors aligns with the study's aim. Once the principal verbally greenlights the project, the researcher forwards a Google Forms link to these teachers. This Google Forms detailed the study's aim, affirmed voluntary participation, and outlined confidentiality measures.

Data Analysis

All 232 surveys were coded after the data was collected. To organize responses, each participant had a specific code. Data from a Google Excel file extracted from Google Forms was input into SPSS. The researcher coded the verbal responses into numerical values using a five-point scale (strongly disagree = 1, disagree = 2, neutral = 3, agree = 4, strongly agree = 5). Descriptive statistics via SPSS (means, standard deviations) portrayed the sample's perspectives. A multiple regression analysis was employed to examine online classroom management predictors by measuring multiple TPCK factors' impacts (CK, TK, PK, PCK, TCK, TPK, and TPACK). A multiple regression analysis (MR) allows you to examine the relationship between a series of independent variables (or predictors) and a single dependent variable (Aiken et al., 2003. Variables were normalized and inspected for normality through skewness values. Statistically, all dependent and independent variables fell within a acceptable range (Schumaker & Lomax, 2016).

FINDINGS

1. What is primary mathematics teachers' perception of TPACK post COVID-19?

Primary mathematics teachers noted high TPACK components (Table 3). The "TK" component had the lowest mean (M = 3.51). Also, ‘‘PK’’ yielded the highest mean (M = 4.10), followed by “PCK” (M= 4.07). In terms of items, the statement “I keep up with important new technologies.” had the lower mean in mathematics teachers' responses (M=3.34). Meanwhile, item ‘‘I can assess student learning in various ways’’ scored the highest (M=4.21).

Table 3
Teachers' perception of TPACK

Item	Mean	SD
1.I keep up with important new technologies.	3.34	1.30
2. I frequently play around with the technology.	3.71	1.20
3. I know about a lot of different technologies.	3.48	1.18
4. I have the technical skills I need to use technology.	3.51	1.11
TK total	3.51	1.01
5. I have sufficient knowledge about my teaching subject.	4.09	1.02
6. I can use a subject-specific way of thinking in my teaching subject.	4.11	.99
7. I know the basic theories and concepts of my teaching subject.	3.88	1.06
8. I know the history and development of important theories in my teaching subject.	3.51	1.10
CK total	3.90	.92
9. I can adapt my teaching based upon what students currently understand or do not understand.	4.10	1.03
10. I can adapt my teaching style to different learners.	4.03	1.02
11. I can use a wide range of teaching approaches in a classroom setting.	4.06	1.06
12. I can assess student learning in multiple ways.	4.21	1.03
PK total	4.10	.94
13. I know how to select effective teaching approaches to guide student thinking and learning in my teaching subject.	4.08	1.01
14. I know how to develop appropriate tasks to promote students' complex thinking of my teaching subject.	3.90	1.03
15. I know how to develop exercises with which students can consolidate their knowledge of my teaching subject.	4.11	1.03
16. I know how to evaluate students' performance in my teaching subject.	4.18	1.02
PCK total	4.07	.93
17. I know how technological developments have changed the field of my subject.	3.88	1.07
18. I can explain which technologies have been used in research in my field .	3.78	1.09
19. I know which new technologies are currently being developed in the field of my subject.	3.65	1.13
20. I know how to use technologies to participate in scientific discourse in my field.	3.69	1.12
TCK total	3.75	1.00
21. I can choose technologies that enhance the teaching approaches for a lesson.	3.74	1.12
22. I can choose technologies that enhance students' learning for a lesson.	3.81	1.06
23. I can adapt the use of the technologies that I am learning about to different teaching activities.	3.69	1.10
24. I am thinking critically about how to use technology in my classroom.	3.81	.97
TPK total	3.76	.952
25. I can use strategies that combine content, technologies, and teaching approaches that I learned about in my coursework in my classroom.	3.84	1.06
26. I can choose technologies that enhance the content for a lesson.	3.80	1.06
27. I can select technologies to use in my classroom that enhance what I teach, how I teach, and what students learn.	3.74	1.07
28. I can teach lessons that appropriately combine my teaching subject, technologies, and teaching approaches.	3.78	1.07
TPCK total	3.79	0.99

2. What is the primary mathematics teachers' perception of self-efficacy in online classroom management?

Primary mathematics teachers reported moderate to high online classroom levels (Table 4). The phrase "There are very few students that I cannot handle during online teaching.'' had the lowest mean score (M = 2.77). Also, the highest mean scores stemmed from "I can manage an online class very well" (M = 3.94), and "I can communicate to students that I am serious about getting appropriate behaviors in online classes." (M= 3.92).

Table 4
Primary mathematics teachers' perception of self-efficacy in online classroom management

No.	Item	Mean	SD
1.	I am able to use a variety of behavior management models and techniques during online teaching.	3.83	1.08
2.	If students disrupt the online lesson, I am able to redirect them quickly.	3.91	1.08
3.	I can communicate to students that I am serious about getting appropriate behaviors in online classes.	3.92	1.14
4.	There are very few students that I cannot handle during online teaching.	2.77	1.23
5.	I can manage an online class very well.	3.94	1.11
6.	I can keep defiant students involved in my online teaching lessons.	3.78	1.06
7.	I am able to make my expectations clear to my students in my online lessons.	3.85	1.11
8.	I can keep a few problem students from ruining an entire online class.	3.85	1.15
9.	When students stop working in online lessons, I can put them back on track	3.71	1.11
10.	I know what rules are appropriate for my students during online lessons.	3.88	1.08
11.	During teaching online, I am able to use a variety of non-aversive techniques (voice modulation, facial expressions, planned ignoring, and proximity control)	3.70	1.11
12.	I am able to implement a consistent online classroom routine	3.74	1.12
13.	I am able to self-evaluate my own online teaching and classroom management skills and use the result constructively.	3.89	1.06
14.	During teaching online, I am able to explain the rational, program components, operation, and evaluation of the behavioral techniques I use.	3.75	.917

3.Is there a relation between TPACK mathematics teachers' perception and teacher self-efficacy in online classroom management?

The results revealed a significant regression analysis ($F[7,231] = 92.74$, $p < .05$], with $R2 = .74$) (Table 3). These findings revealed that some TPACK components impact teachers' perceptions of Classroom Management Self Efficacy in online teaching (Table 5).

Table 5
Summary for multiple regression analysis for teachers’ self-efficacy in online classroom management ß.

Factor	B	SE(B)	ß	t	Sig(p)
(Constant)	.310	.148		2.091	.038
TK	-.027	.052	-.030	-.524	.601
CK	.007	.065	.007	.106	.915
PK	.218	.084	.223	2.606	.010
PCK	.083	.084	.085	.983	.327
TCK	-.017	.079	-.018	-.213	.831
TPK	.277	.084	.287	3.284	.001
TPCK	.343	.075	.371	4.593	<.001
R2	.74				
F	[7,231]				

According to Table 5, standardized regression weights were calculated to measure each predictor's relative contribution. Certain TPACK components, namely PK (b = 0.223, p < 0.001), TPK (b = 0.287, p < 0.001), and TPACK (b = 0.371, p < 0.001), affect teachers' perceptions of online Classroom Management Self-Efficacy. Squared multiple correlation is a measurement for all predictors' cumulative contribution. Collectively, the three predictors explained approximately 74.3% of variance in online Classroom Management Self Efficacy (R2 = 0.743). Correlation results among variables are shown in Table 6. All factors demonstrated significant intercorrelations with online classroom management specifically CK (r =.67), TK (r=.618), PK (r=.75), PCK(r=.77), TPK(r=.808), TPACK(r=.822) as shown in Table 6.

Table 6
Intercorrelations between the study variables

Variables	1	2	3	4	5	6	7	8
CK	1	.63	.81	.78	.65	.66	.69	.67
TK	.63	1	.55	.60	.75	.75	.71	.61
PK	.81	.55	1	.89	.73	.73	.73	.75
PCK	.87	.60	.89	1	.79	.76	.79	.77
TCK	.65	.75	.73	.79	1	.88	.86	.77
TPK	.66	.75	.73	.76	.88	1	.87	.80
TPACK	.69	71	.73	.79	.86	.87	1	.82
CMSEOT	.67	.61	.75	.77	.77	.80	.82	1

Table 6 shows that there is a high degree of intercorrelation between TPACk components, particularly between CK and PK, CK and PCK, and TCK and TPK. The level of intercorrelation between TPACK and CMSEOT was high (.82).

DISCUSSION

Concerning the first research question about post-COVID-19 mathematics teachers' TPACK perspectives, the findings displayed a low response for the TK component (M = 3.5), i.e., technology knowledge level. Respondents reported a low level in keeping up with recent technology, and in searching, utilizing, and understanding technological tools. This result implies that even post COVID-19, mathematics teachers still require further technology education. It's probable that many teachers, including those teaching mathematics, did not receive sufficient training or support for technology integration into their teaching practices. Certain training courses may have been impossible due to insufficient resources and infrastructure. Particularly in subjects like mathematics, teachers might prioritize content expertise over technical skills. Despite subject matter proficiency, they may lack the time or resources required to enhance technological skills. However, PK component was rated high based on participant, suggesting they can adapt to new teaching styles, a broad array of teaching approaches, and various ways of assessing students. This finding reveals that staff development and participants' continuous learning focus on traditional teaching methods.

The pandemic might have afforded teachers more time for self-reflection and professional development. They could have attended online workshops or webinars, or sought further education, to enhance their understanding of mathematics pedagogy and effective teaching practices. Attention focused more on closing the learning gap through in-person teaching rather than online. This finding aligns with numerous other studies suggesting that technology use and TPACK reflect teachers' knowledge as a dynamic construct (Koehler & Mishra, 2009; Taopan et al., 2022). To improve student learning, Smith and Zelkowski (2022) advocate for mathematics educators to acquire knowledge of technology and the optimal ways to apply it in the classroom. Furthermore, Patahuddin et al. (2016) determined that TPACK framework helps teachers identify the knowledge necessary to integrate technology into mathematics instruction. Therefore, technological skills gained by teachers during COVID-19 period must be sustainable to enhance teaching post-pandemic. Other research supports using TPACK in teaching mathematics for effective teaching (Alrwaished et al., 2020; Fahadi & Khan, 2022; Urbina & Polly, 2017.). Multiple studies showcased TPACK's importance in the mathematics teaching process (Alrwaished et al., 2020; Fahadi & Khan, 2022; Urbina & Polly, 2017). Some research concluded that teachers' TPACK is predictive of students' achievement level (Akturk & Ozturk, 2019).

Based on the second research question, teachers reported moderate to high levels of online classroom management self-efficacy (Table 2). The contradicted result appeared between the item with the lowest mean score “There are very few students that I cannot handle during online teaching.’’ (M = 2.7) and the item ‘‘I can manage an online class very well” which had the highest mean scores. This result suggests that despite self-efficacy in classroom management, many teachers still found numerous students challenging to handle. The result underlines the necessity for in-depth exploration into the specific challenges teachers encounter in managing diverse students online, highlighting the importance of understanding nuanced issues. This insight is crucial for developing targeted support and professional development programs to develop teachers' effectiveness in the online teaching setting. This finding corroborates what Alrwaished (2022) study unveiled about the challenges teachers in Kuwait face when teaching mathematics in public schools. These hurdles include teachers' inability to design interactive activities, a lack of emphasis on mathematical reasoning skills for problem-solving, and students' inadequate understanding of the basic elements of mathematics necessary for effective online learning. For online teaching to be successful, both teachers and the students need to share a common set of roles and responsibilities (Ghateolbahra & Samimi ;2021). The success of online education and the realization of intended outcomes are largely dependent on the teaching expertise of instructors capable of effectively managing online learning environments (Paudel, 2021). Despite this, many items in the Classroom Management Self-Efficacy survey in online teaching received a high response rate from teachers. Items describing redirecting students after a lesson disruption, setting clear expectations for students, and seriously communicating with students exhibiting appropriate behavior were highly perceived among teachers. The study's results concluded that certain aspects of classroom management self-efficacy in online teaching were high. During the time pandemic period in Kuwait, teachers acquired skills related to managing Microsoft Teams. They persisted in using this system post-pandemic during urgent situations. Moreover, this finding corroborates Baroudi and Shaya's findings (2022) about the high level of perceived self-efficacy in online teaching. In a 2021 study conducted by Ma et al., it was found that there was an increase in teachers' self-efficacy for using technology in the classroom when surveyed during and after the pandemic. The reasoning proposed by Baroudi and Shaya (2022) could also relate to two additional factors they identified: receiving support in designing online instruction and receiving professional development in online teaching.

Regarding the third question, these findings suggest that some TPACK components influence teachers' perceptions of Classroom Management Self-Efficacy in online teaching. These components, namely PK (Pedagogical Knowledge), TPK (Technological Pedagogical Knowledge), and TPACK, collectively predict 74.3% of the variance in Classroom Management Self-Efficacy in online teaching ($R2 = 0.743$). This result suggests that these two areas are more impactful in Classroom Management Self Efficacy in online teaching. The results align with what Rokhmaniyah et al., (2020) discovered: TPACK approach, combined with the Higher Order Thinking assessment, enhanced teacher competence in class management through technological resources such as videos, worksheets, and assessment tools reliant on Higher Order Thinking. The substantial impact of technological pedagogical knowledge (TPK) and pedagogical knowledge (PK) is evident in online classroom management. By integrating TPK and PK, educators might design engaging activities, tailor learning experiences, encourage collaboration, resolve technical issues, ensure online safety, and efficiently assess progress and outcomes. In the digital era, educators can improve the overall student learning experience by employing these knowledge domains to build an online community that supports students and more efficiently manage online classrooms.

As per Saritepeci (2022), teachers' classroom management skills in technology-enhanced classrooms are influenced by computational thinking, and TPACK components have been identified as a result. Per Saritepeci's (2022) study, teachers with TPACK components are more likely to devise effective solutions for classroom management issues in technology-rich classrooms and prevent the diversification of these problems. Moreover, Liang (2015) found that teachers with high commitment, or high commitment classroom authority, regarded all technologically related knowledge as having greater importance than other teachers (TCK, TPK, and TPACK). In Shen et al.'s study (2023), teachers with higher self-efficacy generally had greater pedagogical content knowledge self-efficacy. Study findings confirm previous studies asserting the importance of mastering TPACK, specifically pedagogical knowledge and technological pedagogical knowledge, to improve teachers' classroom management self-efficacy. According to the study by Ismaeel and Al Mulhim (2022), traditional and online teaching internship strategies are important to develop educators' TPACK skills. Additionally, it provided recommendations for developing technology-enhanced learning opportunities for curriculum developers.

CONCLUSION AND RECOMMENDATION

The results of the study revealed high levels of TPACK components, and moderate to high levels of self-efficacy in managing an online classroom for primary mathematics teachers. They also revealed a significant relationship between TPACK, pedagogical knowledge, and technological pedagogical knowledge, and teachers' classroom management self-efficacy. These findings collectively highlight the complex interdependence among primary mathematics educators' technological incorporation proficiency, pedagogical expertise, and self-assurance in managing online classrooms effectively. This thorough perspective provides valuable insights into the complex factors that influence the teaching practices of primary mathematics educators in the online educational domain.

In fact, online teaching in Kuwait has undergone a lengthy journey, starting from preparation, application during pandemic, to usage in emergencies. The TPACK framework can serve as an assessment tool for teacher competency in applying technology, content knowledge, and pedagogical knowledge. For sustainable Mathematics education, teachers must prepare for the integration of technology and teaching. Staff development programs are highly recommended to maintain the technological skills required by both senior and junior teachers during the pandemic. Online teaching's Classroom Management Self Efficacy can be amplified and overrated through such programs. Cooperation between teachers is also key to bolstering technological and pedagogical skills. Ministry of Education in Kuwait should persist in efforts to incorporate online teaching in urgent situations as it prevents school suspension and ensures learning continuality. Future studies must be done about the influence of technology on mathematics teaching effectiveness and students' achievement in mathematics. Additionally, studies can also be conducted using technology in the face-to-face teaching of mathematics. Exploring the integration of technology in face-to-face mathematics teaching also is recommended.

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